FIG. 1

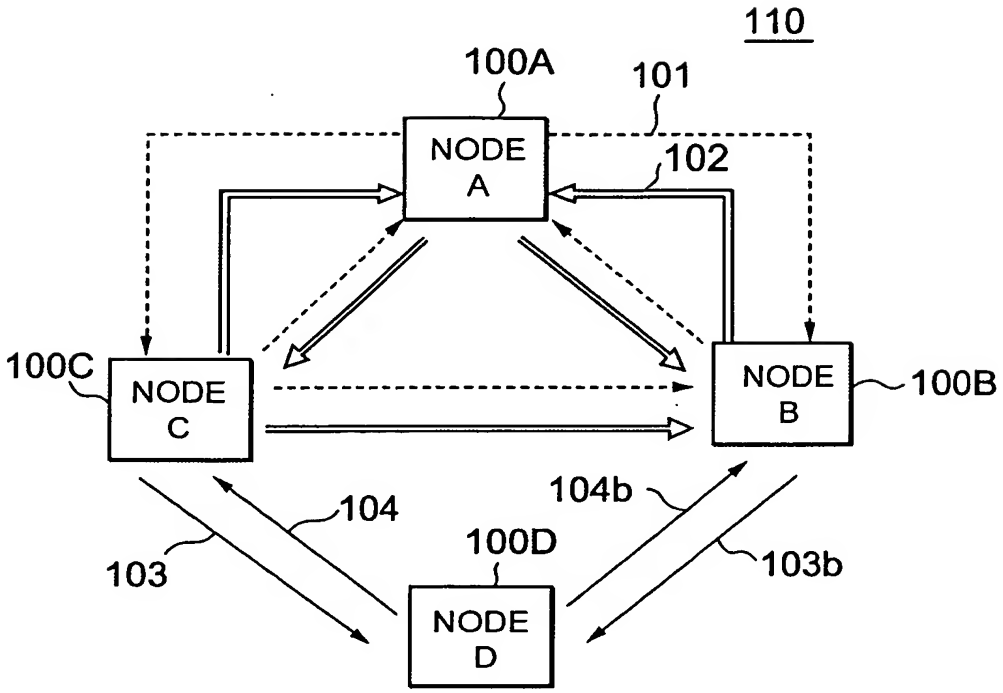

110
100A
101
NODE A
102
100C
NODE C
NODE B
100B
104b
104
100D
103
103b
NODE D

FIG. 2

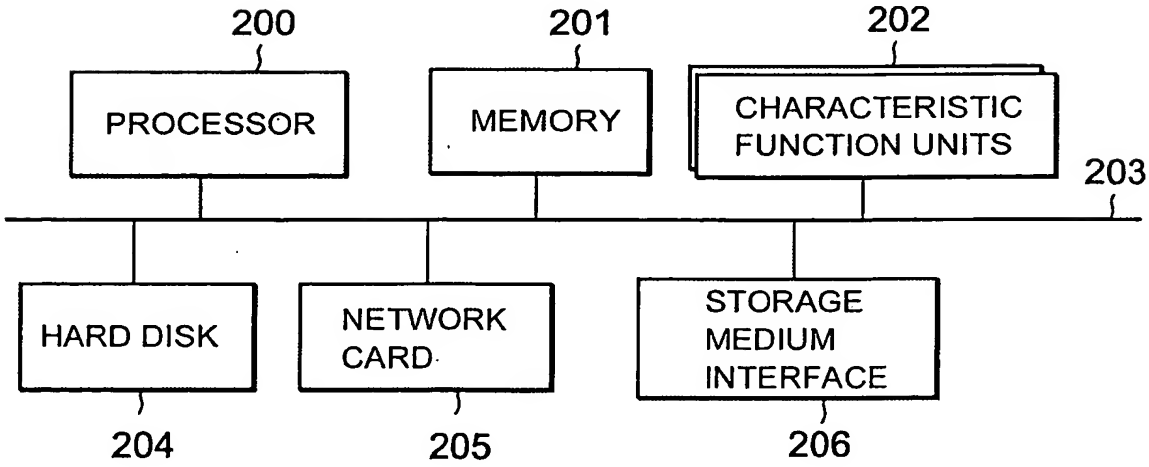

200
201
202
PROCESSOR
MEMORY
CHARACTERISTIC FUNCTION UNITS
203
HARD DISK
NETWORK CARD
STORAGE MEDIUM INTERFACE
204
205
206

FIG. 3

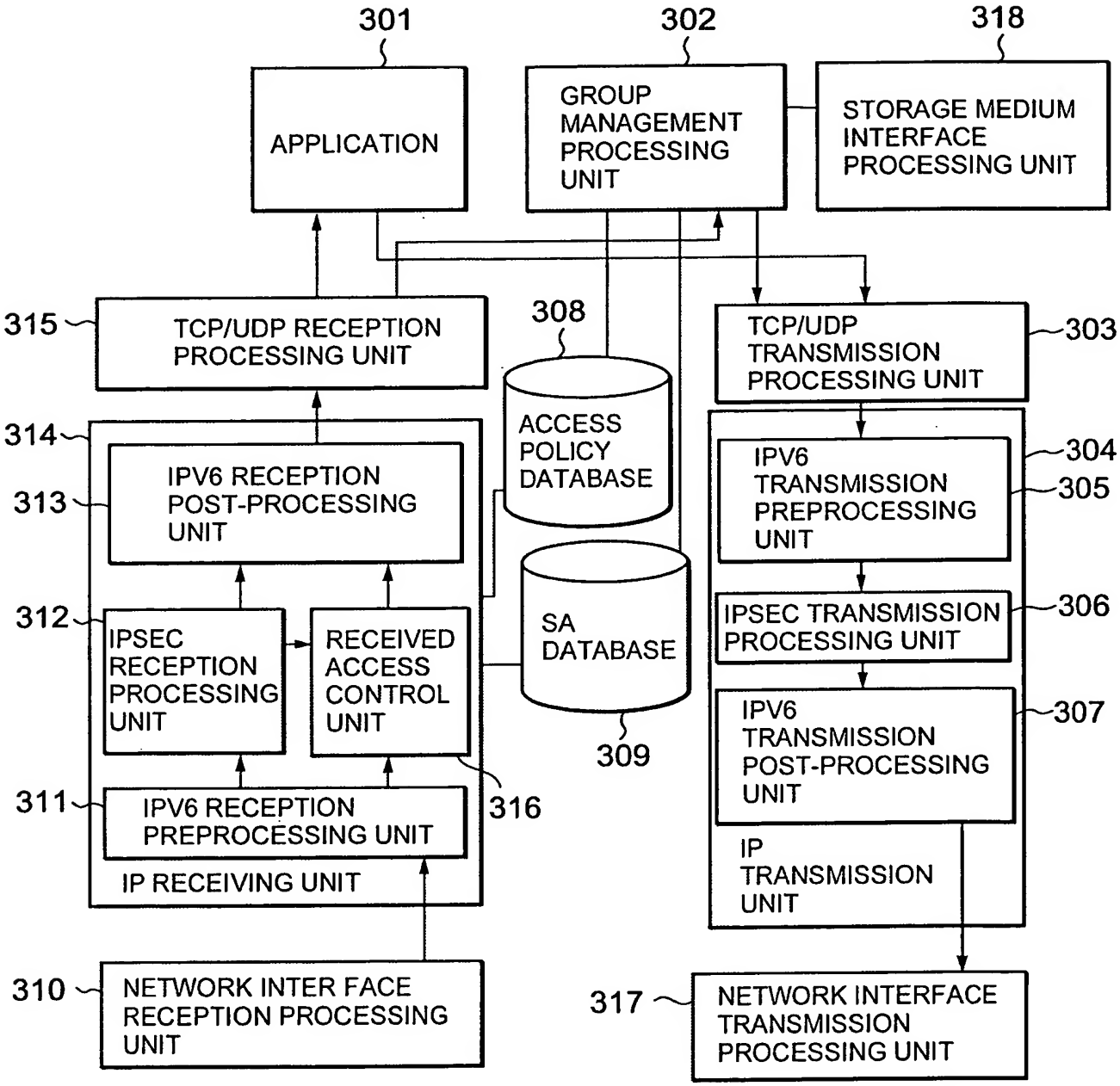

301
302
318
APPLICATION
GROUP MANAGEMENT PROCESSING UNIT
STORAGE MEDIUM INTERFACE PROCESSING UNIT
315
TCP/UDP RECEPTION PROCESSING UNIT
308
ACCESS POLICY DATABASE
TCP/UDP TRANSMISSION PROCESSING UNIT
303
314
313
IPV6 RECEPTION POST-PROCESSING UNIT
IPV6 TRANSMISSION PREPROCESSING UNIT
304
305
312
IPSEC RECEPTION PROCESSING UNIT
RECEIVED ACCESS CONTROL UNIT
SA DATABASE
IPSEC TRANSMISSION PROCESSING UNIT
306
309
IPV6 TRANSMISSION POST-PROCESSING UNIT
307
311
IPV6 RECEPTION PREPROCESSING UNIT
316
IP RECEIVING UNIT
IP TRANSMISSION UNIT
310
NETWORK INTER FACE RECEPTION PROCESSING UNIT
317
NETWORK INTERFACE TRANSMISSION PROCESSING UNIT

FIG. 4

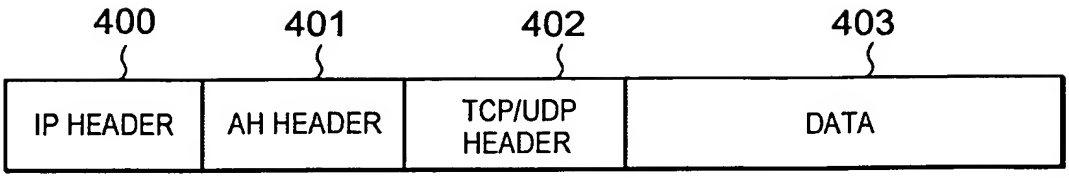

400
401
402
403
IP HEADER
AH HEADER
TCP/UDP HEADER
DATA

FIG. 5

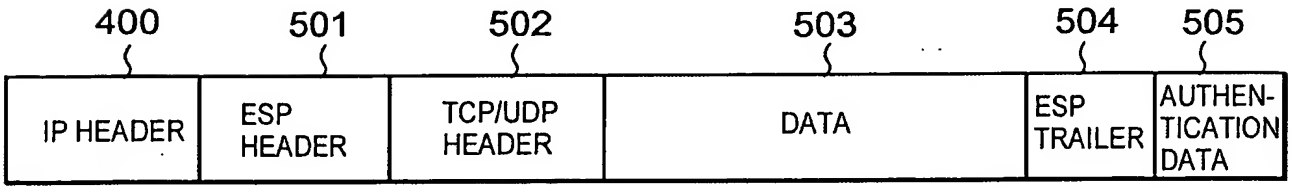

400
501
502
503
504
505
IP HEADER
ESP HEADER
TCP/UDP HEADER
DATA
ESP TRAILER
AUTHEN-TICATION DATA

FIG. 6

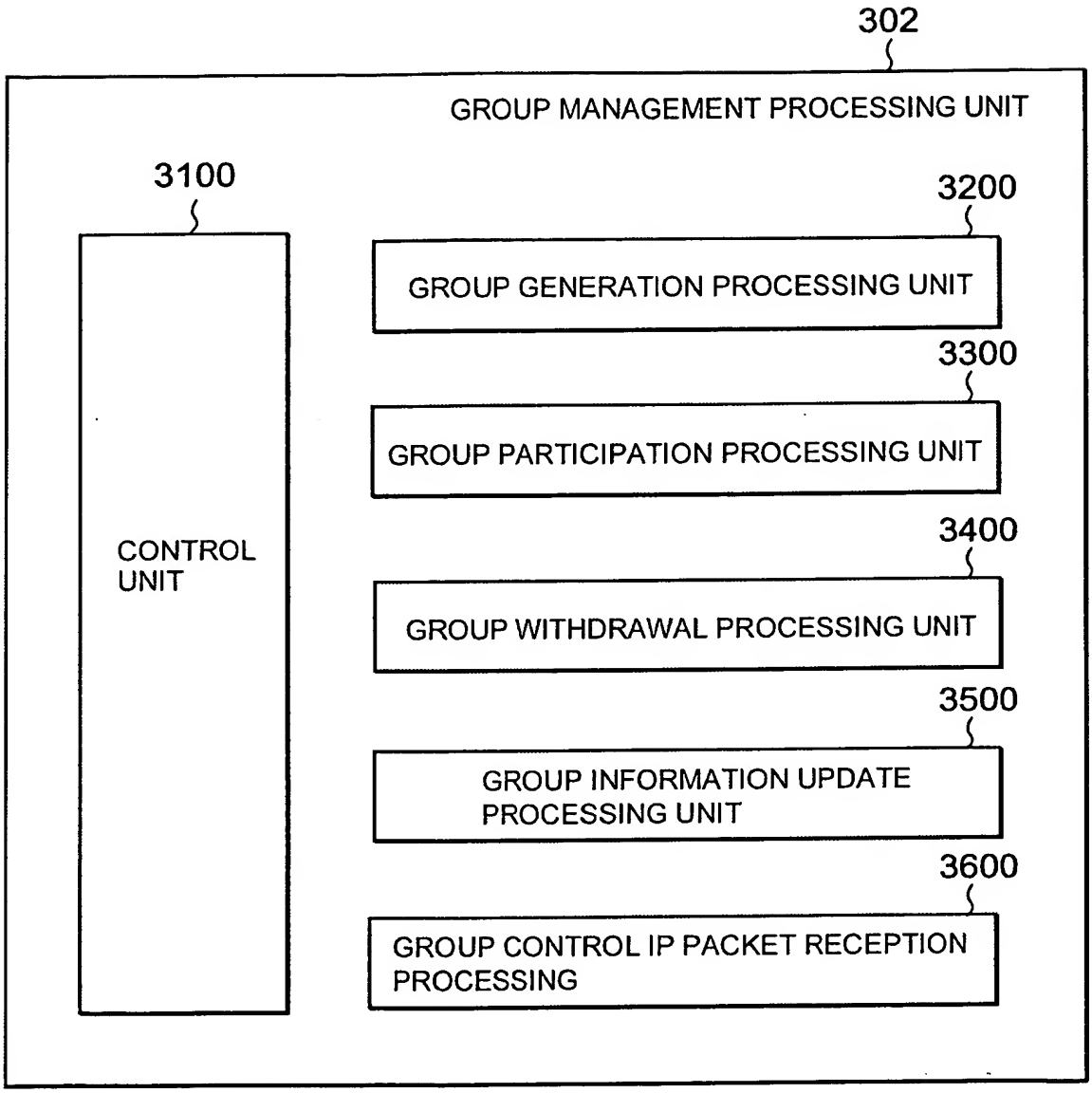

302
GROUP MANAGEMENT PROCESSING UNIT
3100
CONTROL UNIT
3200
GROUP GENERATION PROCESSING UNIT
3300
GROUP PARTICIPATION PROCESSING UNIT
3400
GROUP WITHDRAWAL PROCESSING UNIT
3500
GROUP INFORMATION UPDATE PROCESSING UNIT
3600
GROUP CONTROL IP PACKET RECEPTION PROCESSING

FIG. 7

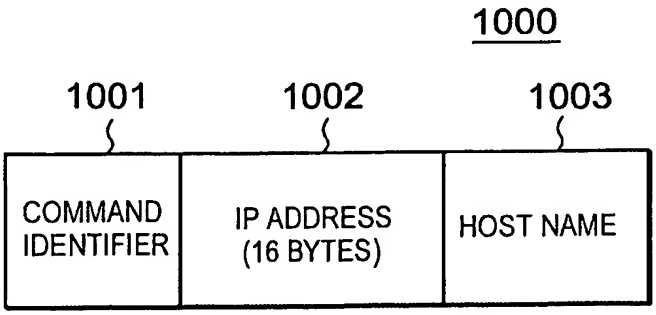

1000
1001
1002
1003
COMMAND IDENTIFIER
IP ADDRESS (16 BYTES)
HOST NAME

FIG. 8

GROUP MANAGEMENT TABLE

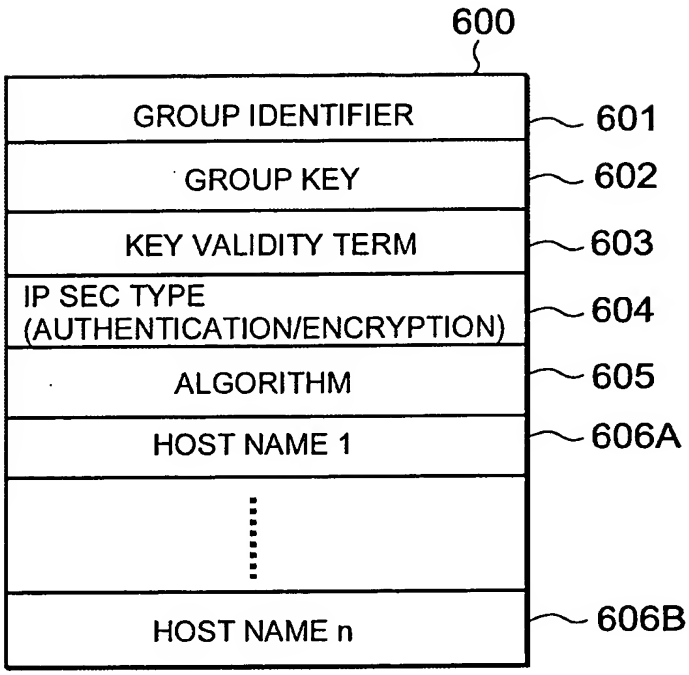


FIG. 9

ACCESS CONTROL OBJECT APPLICATION
MANAGEMENT TABLE

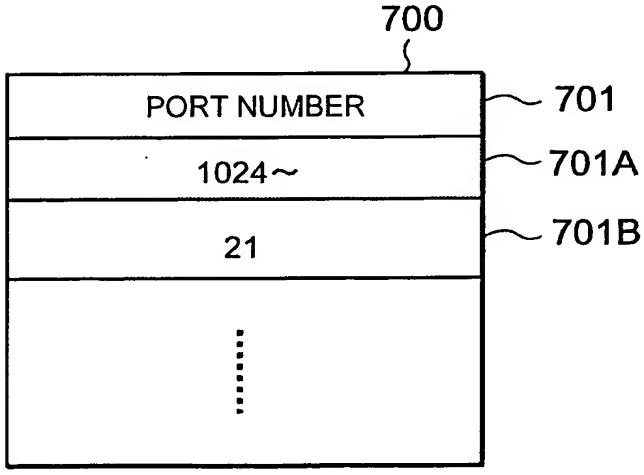


FIG.10

GROUP MEMBER MANAGEMENT TABLE 800

801 HOST NAME	802 IP ADDRESS	803 VALIDITY TERM
NODE A	FE 80 :: 68 12 54 FE 35 01	× × × ×
⋮	⋮	⋮

FIG.11

SECURITY ASSOCIATION 900

SPI	GROUP IDENTIFIER
SENDER' S IP ADDRESS	FE 80 :: 68 12 54 FE 35 01
DESTINATION IP ADDRESS	FE 80 :: 68 12 54 FE 35 02
PROTOCOL	AH
MODE	TRANSPORT
ENCRYPTION ALGORITHM	——
ENCRYPTION KEY	——
AUTHENTICATION ALGORITHM	SHA-1
AUTHENTICATION KEY	GROUP KEY IN THE GROUP MANAGEMENT TABLE
VALIDITY TERM	IN 7 DAYS

FIG.12

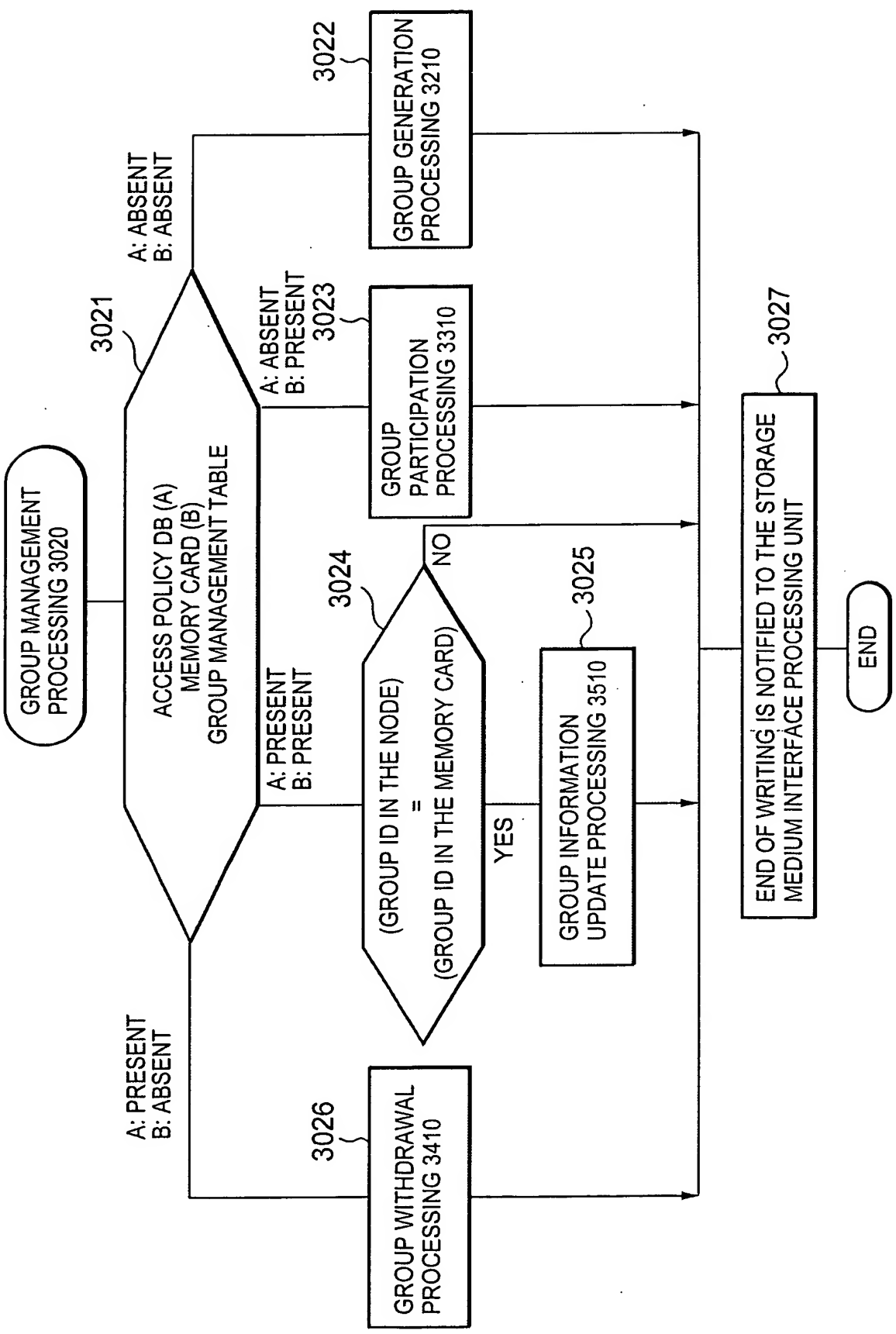

GROUP MANAGEMENT PROCESSING 3020
ACCESS POLICY DB (A)
MEMORY CARD (B)
GROUP MANAGEMENT TABLE
3021
A: ABSENT
B: ABSENT
3022
GROUP GENERATION PROCESSING 3210
A: ABSENT
B: PRESENT
3023
GROUP PARTICIPATION PROCESSING 3310
A: PRESENT
B: PRESENT
3024
(GROUP ID IN THE NODE)
=
(GROUP ID IN THE MEMORY CARD)
NO
YES
3025
GROUP INFORMATION UPDATE PROCESSING 3510
A: PRESENT
B: ABSENT
3026
GROUP WITHDRAWAL PROCESSING 3410
3027
END OF WRITING IS NOTIFIED TO THE STORAGE MEDIUM INTERFACE PROCESSING UNIT
END

FIG.13

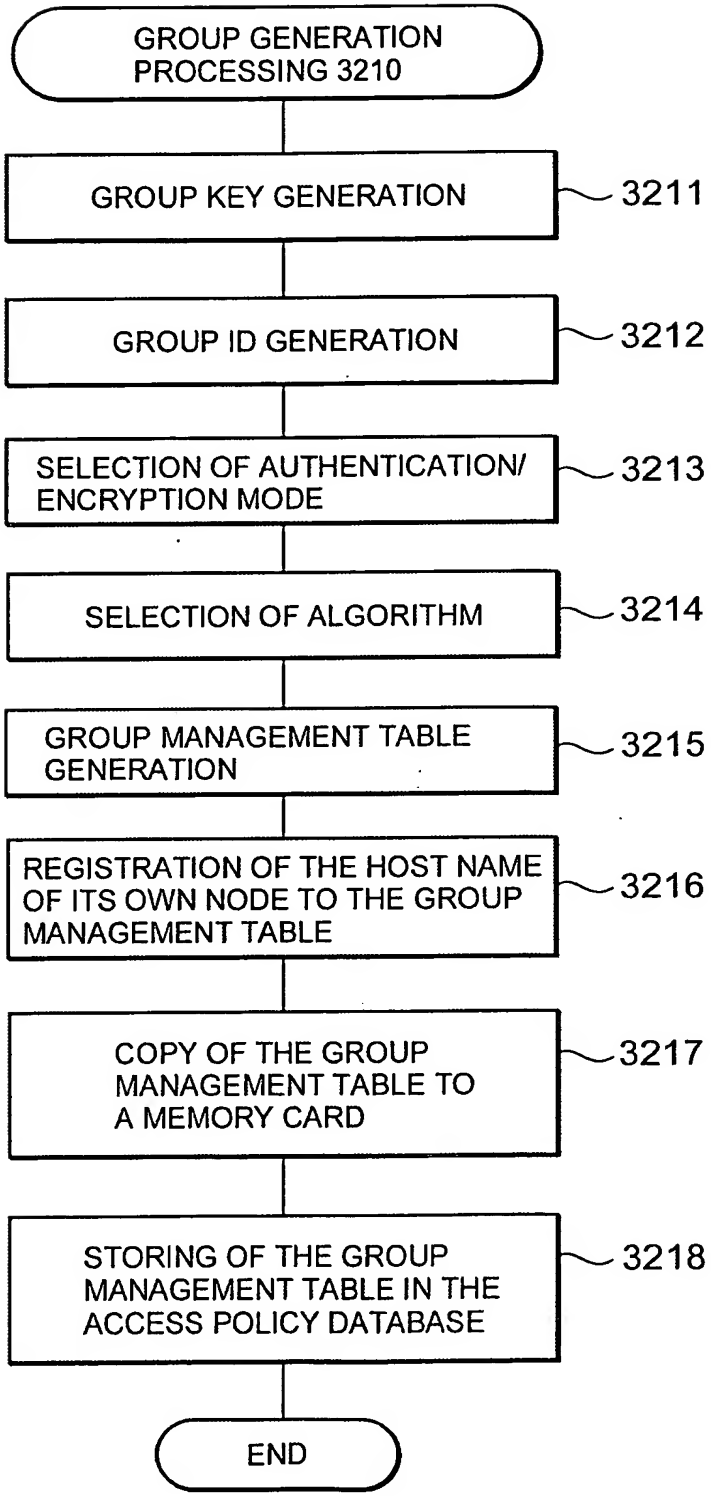

GROUP GENERATION PROCESSING 3210
GROUP KEY GENERATION
3211
GROUP ID GENERATION
3212
SELECTION OF AUTHENTICATION/ ENCRYPTION MODE
3213
SELECTION OF ALGORITHM
3214
GROUP MANAGEMENT TABLE GENERATION
3215
REGISTRATION OF THE HOST NAME OF ITS OWN NODE TO THE GROUP MANAGEMENT TABLE
3216
COPY OF THE GROUP MANAGEMENT TABLE TO A MEMORY CARD
3217
STORING OF THE GROUP MANAGEMENT TABLE IN THE ACCESS POLICY DATABASE
3218
END

FIG.14

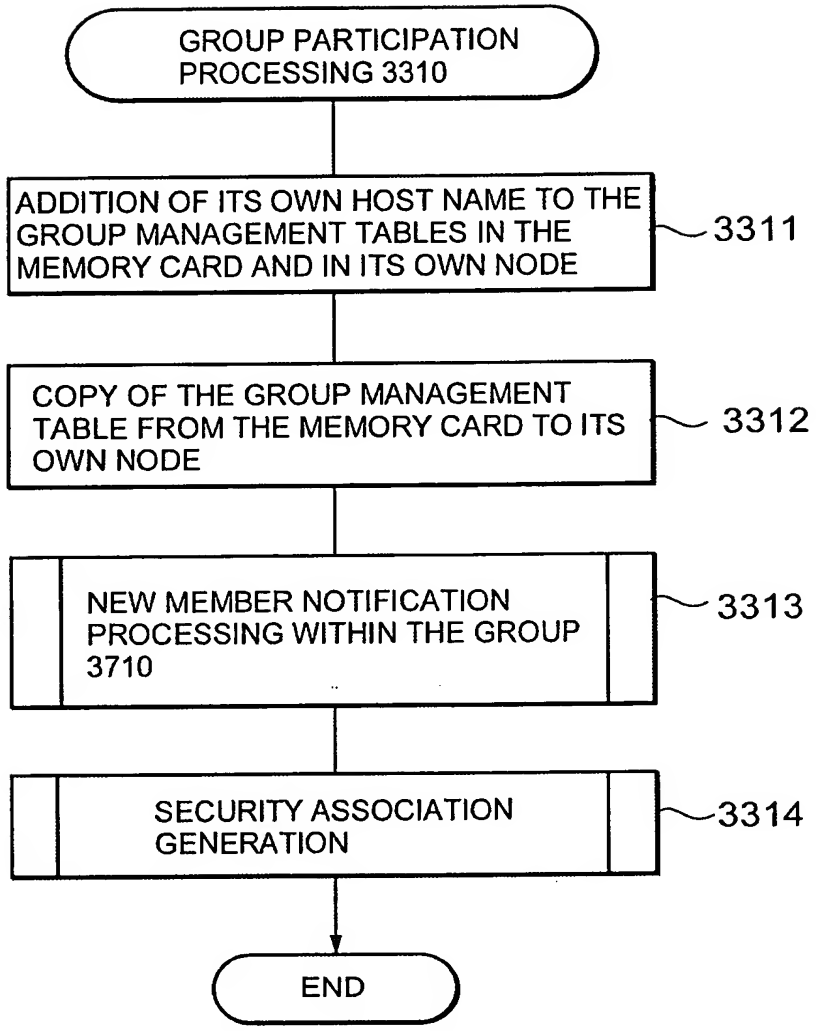

GROUP PARTICIPATION PROCESSING 3310
ADDITION OF ITS OWN HOST NAME TO THE GROUP MANAGEMENT TABLES IN THE MEMORY CARD AND IN ITS OWN NODE
3311
COPY OF THE GROUP MANAGEMENT TABLE FROM THE MEMORY CARD TO ITS OWN NODE
3312
NEW MEMBER NOTIFICATION PROCESSING WITHIN THE GROUP 3710
3313
SECURITY ASSOCIATION GENERATION
3314
END

FIG.15

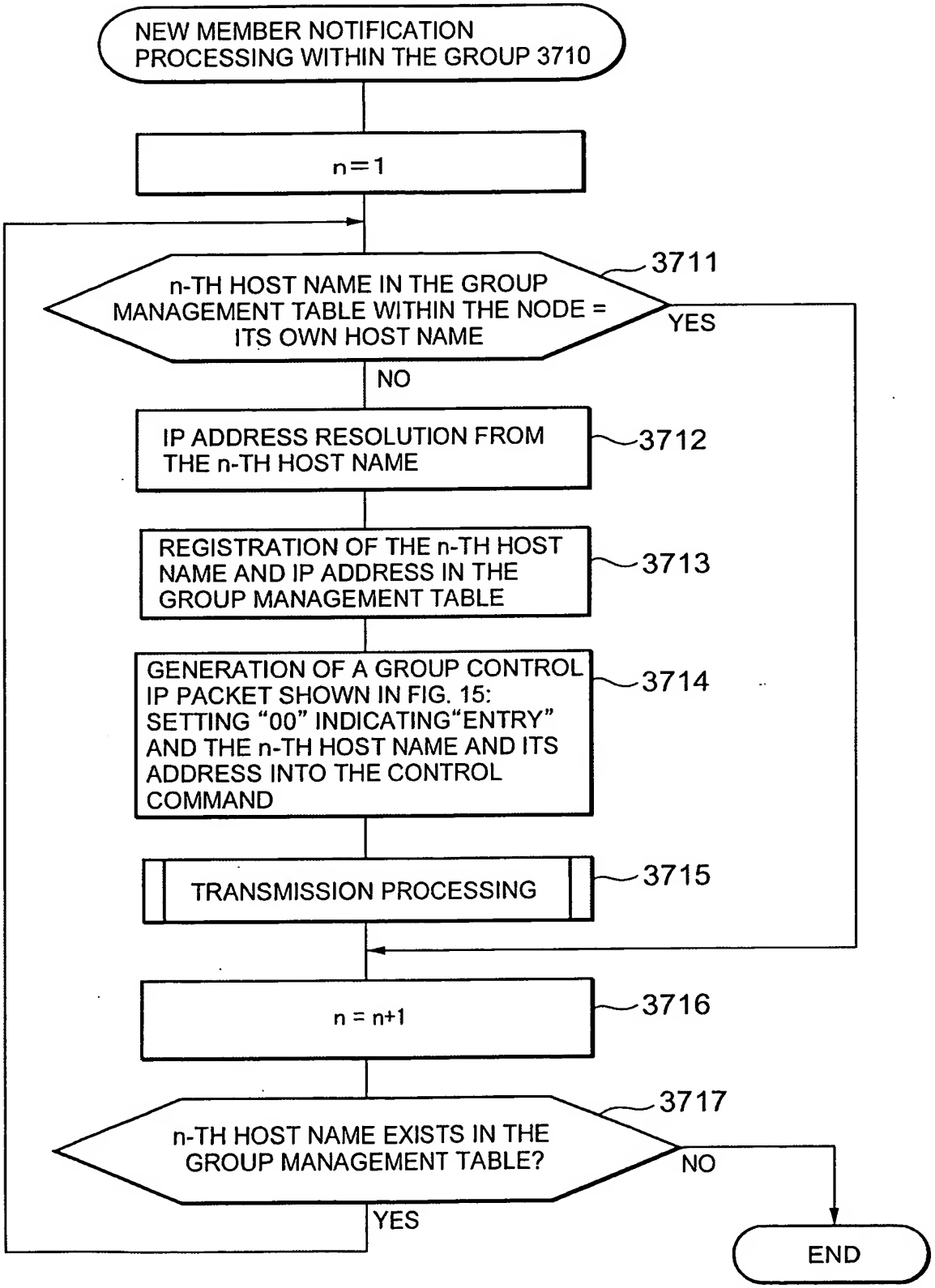

NEW MEMBER NOTIFICATION PROCESSING WITHIN THE GROUP 3710
n=1
n-TH HOST NAME IN THE GROUP MANAGEMENT TABLE WITHIN THE NODE = ITS OWN HOST NAME
3711
YES
NO
IP ADDRESS RESOLUTION FROM THE n-TH HOST NAME
3712
REGISTRATION OF THE n-TH HOST NAME AND IP ADDRESS IN THE GROUP MANAGEMENT TABLE
3713
GENERATION OF A GROUP CONTROL IP PACKET SHOWN IN FIG. 15: SETTING "00" INDICATING"ENTRY" AND THE n-TH HOST NAME AND ITS ADDRESS INTO THE CONTROL COMMAND
3714
TRANSMISSION PROCESSING
3715
n = n+1
3716
n-TH HOST NAME EXISTS IN THE GROUP MANAGEMENT TABLE?
3717
NO
YES
END

FIG.16

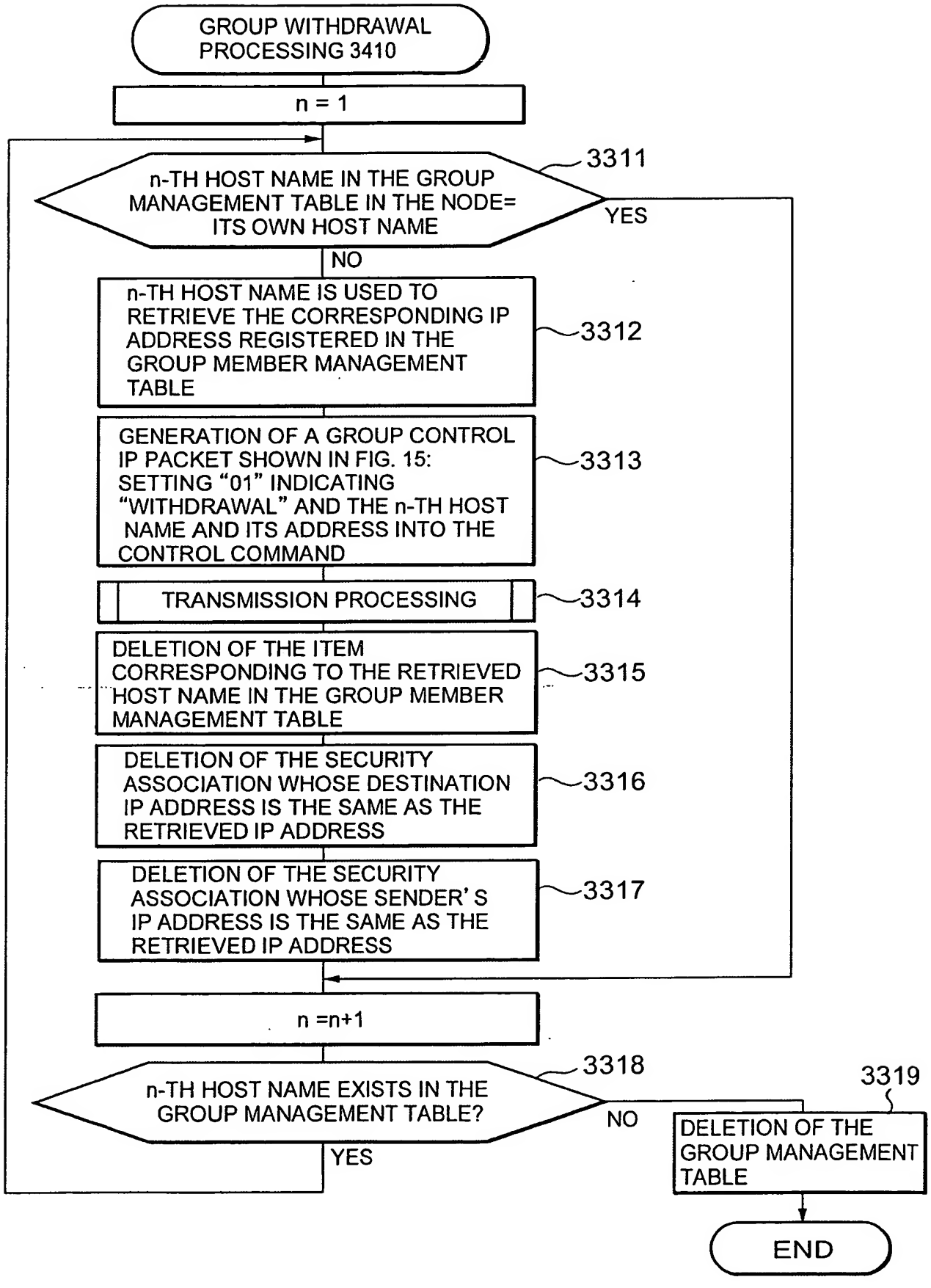

GROUP WITHDRAWAL PROCESSING 3410
n = 1
n-TH HOST NAME IN THE GROUP MANAGEMENT TABLE IN THE NODE= ITS OWN HOST NAME
3311
YES
NO
n-TH HOST NAME IS USED TO RETRIEVE THE CORRESPONDING IP ADDRESS REGISTERED IN THE GROUP MEMBER MANAGEMENT TABLE
3312
GENERATION OF A GROUP CONTROL IP PACKET SHOWN IN FIG. 15: SETTING "01" INDICATING "WITHDRAWAL" AND THE n-TH HOST NAME AND ITS ADDRESS INTO THE CONTROL COMMAND
3313
TRANSMISSION PROCESSING
3314
DELETION OF THE ITEM CORRESPONDING TO THE RETRIEVED HOST NAME IN THE GROUP MEMBER MANAGEMENT TABLE
3315
DELETION OF THE SECURITY ASSOCIATION WHOSE DESTINATION IP ADDRESS IS THE SAME AS THE RETRIEVED IP ADDRESS
3316
DELETION OF THE SECURITY ASSOCIATION WHOSE SENDER' S IP ADDRESS IS THE SAME AS THE RETRIEVED IP ADDRESS
3317
n =n+1
n-TH HOST NAME EXISTS IN THE GROUP MANAGEMENT TABLE?
3318
NO
YES
3319
DELETION OF THE GROUP MANAGEMENT TABLE
END

FIG.17

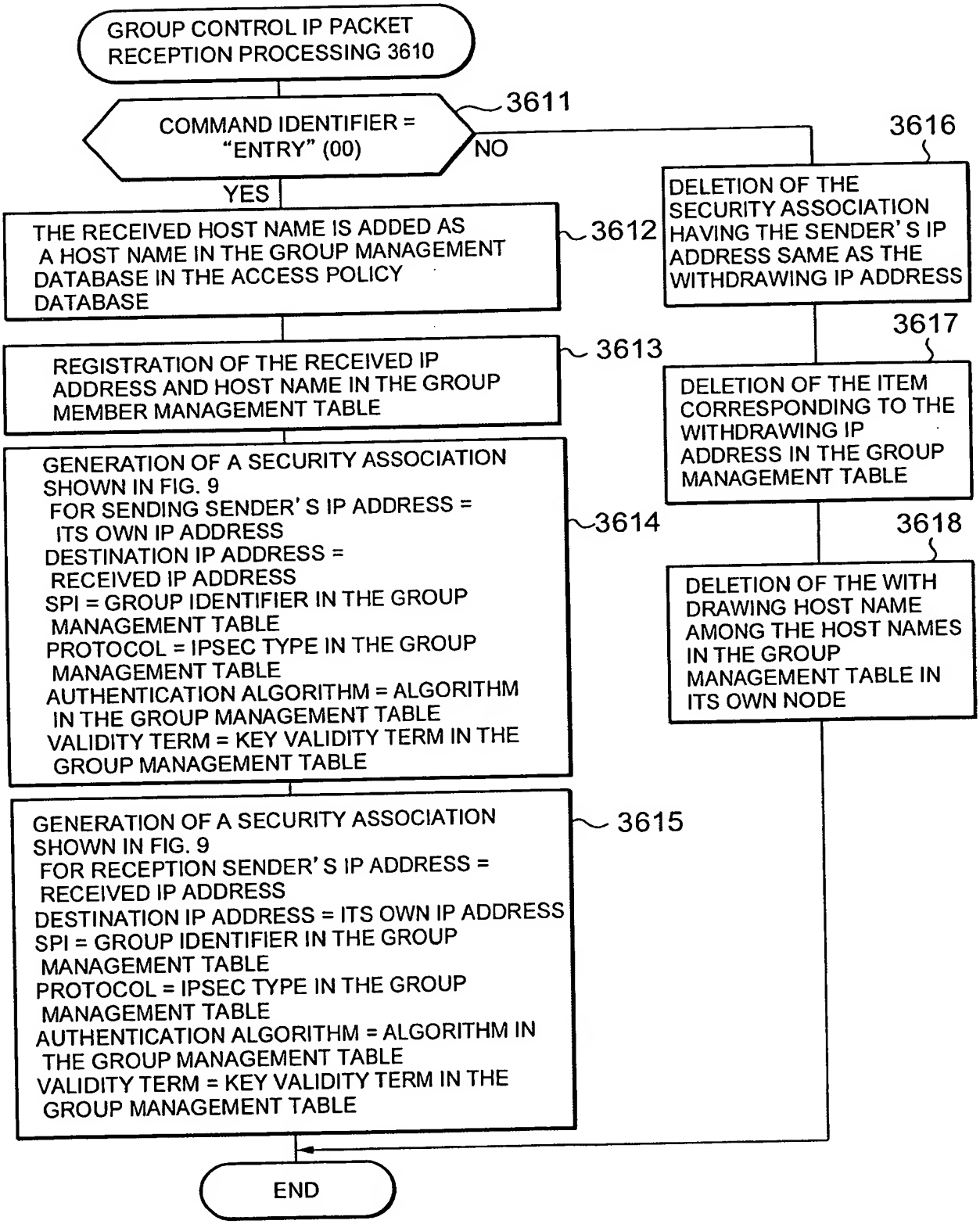

GROUP CONTROL IP PACKET RECEPTION PROCESSING 3610
COMMAND IDENTIFIER = "ENTRY" (00)
3611
NO
YES
3616
DELETION OF THE SECURITY ASSOCIATION HAVING THE SENDER'S IP ADDRESS SAME AS THE WITHDRAWING IP ADDRESS
THE RECEIVED HOST NAME IS ADDED AS A HOST NAME IN THE GROUP MANAGEMENT DATABASE IN THE ACCESS POLICY DATABASE
3612
3617
REGISTRATION OF THE RECEIVED IP ADDRESS AND HOST NAME IN THE GROUP MEMBER MANAGEMENT TABLE
3613
DELETION OF THE ITEM CORRESPONDING TO THE WITHDRAWING IP ADDRESS IN THE GROUP MANAGEMENT TABLE
GENERATION OF A SECURITY ASSOCIATION SHOWN IN FIG. 9
FOR SENDING SENDER'S IP ADDRESS = ITS OWN IP ADDRESS
DESTINATION IP ADDRESS = RECEIVED IP ADDRESS
SPI = GROUP IDENTIFIER IN THE GROUP MANAGEMENT TABLE
PROTOCOL = IPSEC TYPE IN THE GROUP MANAGEMENT TABLE
AUTHENTICATION ALGORITHM = ALGORITHM IN THE GROUP MANAGEMENT TABLE
VALIDITY TERM = KEY VALIDITY TERM IN THE GROUP MANAGEMENT TABLE
3614
3618
DELETION OF THE WITH DRAWING HOST NAME AMONG THE HOST NAMES IN THE GROUP MANAGEMENT TABLE IN ITS OWN NODE
GENERATION OF A SECURITY ASSOCIATION SHOWN IN FIG. 9
FOR RECEPTION SENDER'S IP ADDRESS = RECEIVED IP ADDRESS
DESTINATION IP ADDRESS = ITS OWN IP ADDRESS
SPI = GROUP IDENTIFIER IN THE GROUP MANAGEMENT TABLE
PROTOCOL = IPSEC TYPE IN THE GROUP MANAGEMENT TABLE
AUTHENTICATION ALGORITHM = ALGORITHM IN THE GROUP MANAGEMENT TABLE
VALIDITY TERM = KEY VALIDITY TERM IN THE GROUP MANAGEMENT TABLE
3615
END

FIG.18

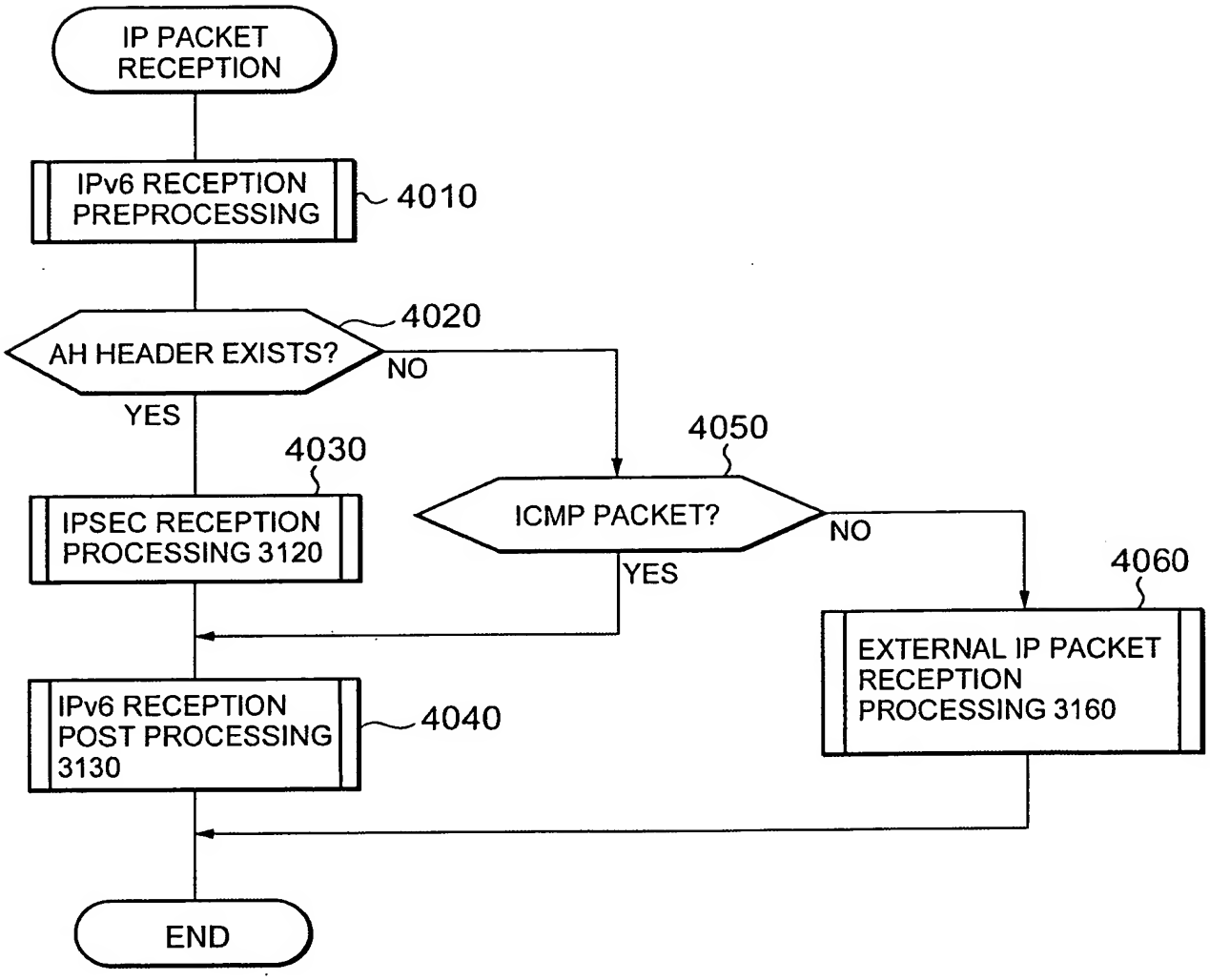
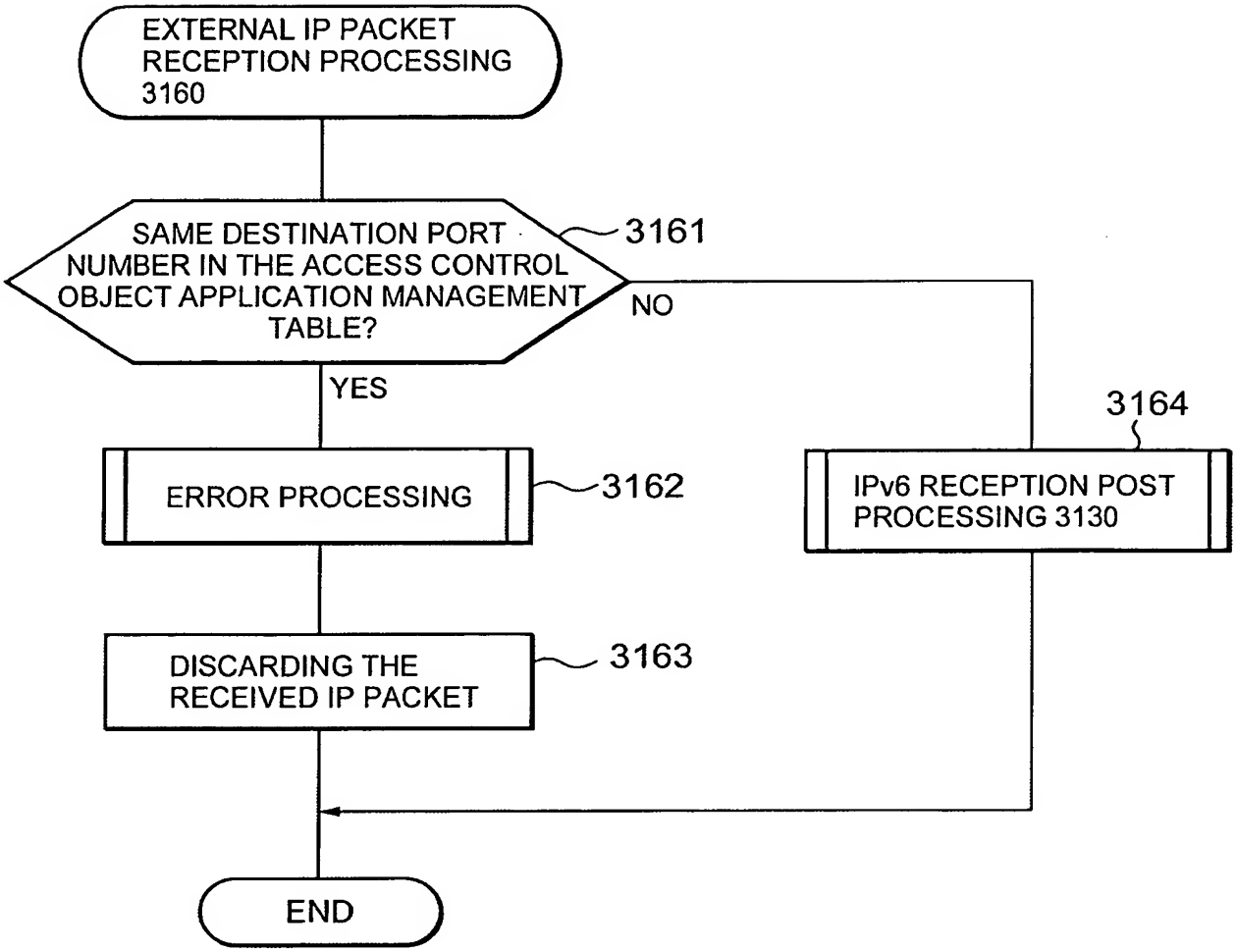

IP PACKET RECEPTION
IPv6 RECEPTION PREPROCESSING
4010
AH HEADER EXISTS?
4020
NO
YES
4030
IPSEC RECEPTION PROCESSING 3120
4050
ICMP PACKET?
NO
YES
4060
EXTERNAL IP PACKET RECEPTION PROCESSING 3160
IPv6 RECEPTION POST PROCESSING 3130
4040
END

FIG.19


EXTERNAL IP PACKET RECEPTION PROCESSING 3160
SAME DESTINATION PORT NUMBER IN THE ACCESS CONTROL OBJECT APPLICATION MANAGEMENT TABLE?
3161
NO
YES
3164
ERROR PROCESSING
3162
IPv6 RECEPTION POST PROCESSING 3130
DISCARDING THE RECEIVED IP PACKET
3163
END